DATASHEET

Radar Systems with AWR Software

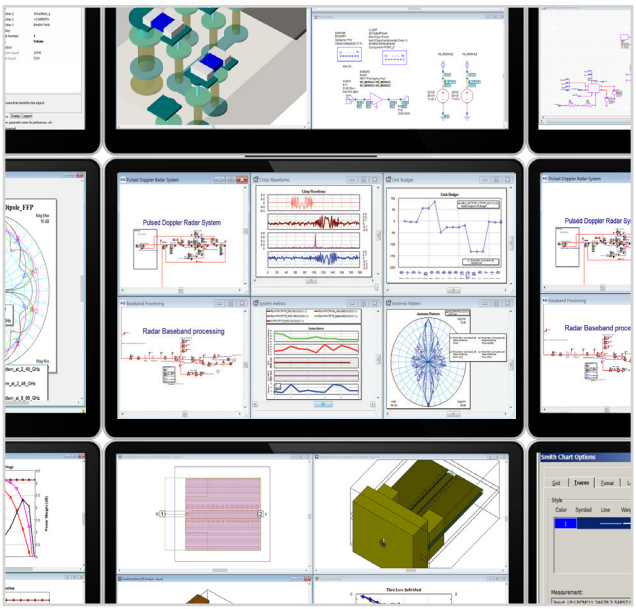
Software technologies and library support simulation and modeling of radar systems

Radar systems can be classified as ground-based, airborne, space-borne, or ship-based as well as by frequency band, antenna, or waveform type. Additionally, functionality can vary from tracking to early warning, to over the horizon, and more. The Cadence® AWR Design Environment® platform for radar system design enables detailed behavioral modeling of the RF and signal processing of a radar system, together with 3D antenna patterns derived from synthesis or measurement. Third-party links to custom signal processing algorithms and test and measurement (T&M) instruments allow a device under test (DUT) to be incorporated into the simulation, where real-world signals can be captured or an impaired signal synthesized from a point in the simulated system.

Radar Advantage

Radar systems are complex and depend heavily on signal processing algorithms to mitigate the effects of noise and interference. This places heavy demands on the tool chain and therefore requires a platform that supports simulation, verification, and models for signal generation, transmission, antenna, T/R switching, clutter, noise, jamming, receiving, signal processing, and measurements.

The Cadence AWR® Visual System Simulator™ (VSS) software for radar systems design supports all of this, from algorithm modeling all the way through to debugging environment via languages such as C++, LabVIEW, MATLAB, and VBA.



Product Strengths

RF Modeling

Modeling of the RF chains of a radar system is supported through the RFA capability within the AWR VSS software, which uses a frequency-domain engine to provide budget or line-up analysis similar to that available in Microsoft Excel, as well as spurious analysis based on mixer spur tables. The advantage is accuracy and speed as it accounts for impedance mismatch and frequency dependencies. Spurs arising from the mixing process, characterized by mixer IMT tables, can be tracked through the system, and the heritage, order and type of spur (signal, distortion, or interference).

Antennas and Phased Arrays

Antenna and phased array models are available, as is ASCII file import of antenna patterns containing data versus theta and phi. This data may be obtained from electromagnetic (EM) simulation as well as measurements. The receive antenna can then accept multiple inputs representing wanted signal, clutter, and jammers (all at arbitrary theta and phi).

DSP and Detection

Target detection cannot be done effectively and realistically in the time domain because small moving targets are hidden by heavily cluttered environments. Instead, detection of the signal occurs in the frequency domain using Doppler frequency analysis.

Features

Highlights

- Element tree supporting signal processing/antenna models
- Channel model inclusive of Doppler and clutter
- Target models account for radar cross-section (RCS)
- Radar signal generators
- Signal processing blocks
  - Moving target indicator (MTI)
  - Moving target detection (MTD)
  - Constant false alarm rate (CFAR)
- Antenna model
  - Accept gain pattern
  - Phased array element

Radar Waveforms and Metrics	
CW Radar	**Noise and Interference**
No range detection	Thermal background, NF, spurs, group delay
CW FM Modulation	**Beam Width and Range**
Linear frequency versus time Beat frequency modulator IF-Frequency varies with range Requires separate TX/RX antenna–e.g., aircraft altimeter	Line of sight depends on height above ground Maximum unambiguous range (MUR) Radar sensitivity and power of return-radar equation
Pulsed Radar	**Pulsed FM Chirp**
Range detection Single antenna switch TX to RX using duplexer Min range =PW*C/2, Max range = PRT *C/2 Resolution limited by pulse width	Range detection and processing gain Matched filter allows pulse compression Overcomes limited resolution PW~1/BW Provides processing gain against noise-adds to radar equation
Clutter	**Jamming**
Unwanted targets-ground, sea, atmospherics, buildings Multi-path–moving “ghosts” of valid target Constant False Alarm Rate (CFAR)	EW intentional jamming Equipment operating in same band Not governed by radar equation–1-way travel

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